

TITLE OF THE INVENTION

Thin Film Magnetic Memory Device for Programming Required
Information with an Element Similar to a Memory Cell and Information
Programming Method

TL 5 BACKGROUND OF THE INVENTION *A RELATED APPLICATION: This Application is a Continuation of U.S. application Ser. No. 10/234,243 filed Sep. 05, 2002, now U.S. Pat. No. 6,683,807.*

Field of the Invention

The present invention generally relates to a thin film magnetic
memory device. More particularly, the present invention relates to a
random access memory (RAM) including memory cells having a magnetic
10 tunnel junction (MTJ), and an information programming method.

Description of the Background Art

An MRAM (Magnetic Random Access Memory) device has attracted
attention as a memory device capable of non-volatile data storage with low
power consumption. The MRAM device is a memory device capable of non-
15 volatile data storage using a plurality of thin film magnetic elements
formed in a semiconductor integrated circuit and also capable of random
access to each thin film magnetic element.

In particular, recent announcement shows that the use of thin film
magnetic elements having a magnetic tunnel junction (MTJ) as memory
20 cells significantly improves performance of the MRAM device. The MRAM
device including memory cells having a magnetic tunnel junction is
disclosed in technical documents such as "A 10ns Read and Write Non-
Volatile Memory Array Using a Magnetic Tunnel Junction and FET Switch
in each Cell", ISSCC Digest of Technical Papers, TA7.2, Feb. 2000,
25 "Nonvolatile RAM based on Magnetic Tunnel Junction Elements", ISSCC
Digest of Technical Papers, TA7.3, Feb. 2000, and "A 256kb 3.0V 1T1MTJ
Nonvolatile Magnetoresistive RAM", ISSCC Digest of Technical Papers,
TA7.6, Feb. 2001.

Fig. 31 schematically shows the structure of a memory cell having a
30 magnetic tunnel junction (hereinafter, sometimes simply referred to as
"MTJ memory cell").

Referring to Fig. 31, the MTJ memory cell includes a tunneling
magneto-resistance element TMR having an electric resistance varying